# RuggedSwitch®
# RS8000 Family

Installation Guide

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## Federal Communications Commission Radio Frequency Interference Statement

*This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference on his own expense.*

Warning: Changes or modifications not expressly approved by RuggedCom Inc. could void the user's authority to operate the equipment.

## Important:

The RS8000 family of Ethernet switches contains no user serviceable parts. Attempted service by unauthorized personnel shall render all warranties null and void.

All RS8000 type units should be installed in a restricted access location where access can only be gained by service personnel or users who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken; and access is through the use of a tool or lock and key, or other means of security, and is controlled by the authority responsible for the location.

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# 1 Product Overview

## *1.1 Functional Overview*

The RuggedSwitch™ RS8000 Family of switches (RS8000X) are substation hardened, fiber optical Ethernet switches specifically designed to operate in harsh environments such as those found in electric utility substations and harsh industrial environments. The RS8000 family provides multiple fiber optical port and speed selections as well as 10/100 RJ45 twisted-pair connectivity as well.

Specifically tested to the same standards as mission critical protective relaying equipment (i.e. ANSI/IEEE C37.90 and IEC 60255), the RS8000X is ideally suited to form the Ethernet network in a UCA2 (Utility Communications Architecture 2.0) based substation automation network. Because the RS8000 series was designed to meet the demands of the substation environment it is also ideally suited for industrial automation networks based on Industrial Ethernet. The reliability of the RS8000X exceeds that of commercial Ethernet switches by having no rotating mechanical parts such as cooling fans and by utilizing high-temperature solid-state components.

## *1.2 Feature Highlights*

- Utility Grade (i.e. substation hardened) per ANSI/IEEE C37.90, IEC 60255, and the new IEC 61850-3 (2002), IEC 61000-6-5 standards
- Operating temperature: -40° to 85°C (no fan)
- Radiated RF Immunity: 35V/m per ANSI/IEEE C37.90.2
- Power supply options: 12, 24 or 48 VDC, and universal HI (88-300VDC or 84-264VAC)
- Failsafe output relay for critical failure or error alarming
- Advanced layer 2 switching functions: 802.1p Message Prioritization, 802.1Q VLAN
- Full-duplex operation (no collisions)

## *1.3 RS8000 Family Overview*

The RS8000 series Ethernet switch is available in several models to provide connectivity to a number of different design topologies and to serve a greater number of end-devices. The models details are shown below. All RS8000 models feature the same power supply options and mechanical dimensions.

| RS8000 Family Overview | | | |
|---|---|---|---|
| Model | Quantity | Ports Type Options and Media | Connector Type |
| RS8000 | 8 | 100BaseFX Multi-mode Fiber | MTRJ |
| | | 100BaseFX Single-mode Fiber | LC |
| RS8000T | 2 | 100BaseFX Multi-mode Fiber | MTRJ |
| | | 100BaseFX Single-mode Fiber | LC |
| | 6 | Auto-negotiating 10BaseT / 100BaseTx Twisted Pair | RJ45 |
| RS8000A | 4 | 100BaseFX Multi-mode Fiber | MTRJ |
| | | 100BaseFX Single-mode Fiber | LC |
| | 2 | 10BaseFL Multi-mode Fiber | ST |
| | | 10BaseFL Single-mode Fiber | ST |
| | 2 | Auto-negotiating 10BaseT / 100BaseTx Twisted Pair | RJ45 |
| RS8000H | 4 | 100BaseFX Multi-mode Fiber | SC or ST |
| | | 100BaseFX Single-mode Fiber | SC or ST |
| | 4 | Auto-negotiating 10BaseT / 100BaseTx Twisted Pair | RJ45 |

## 1.4 RS8000 Family Front Panel Description

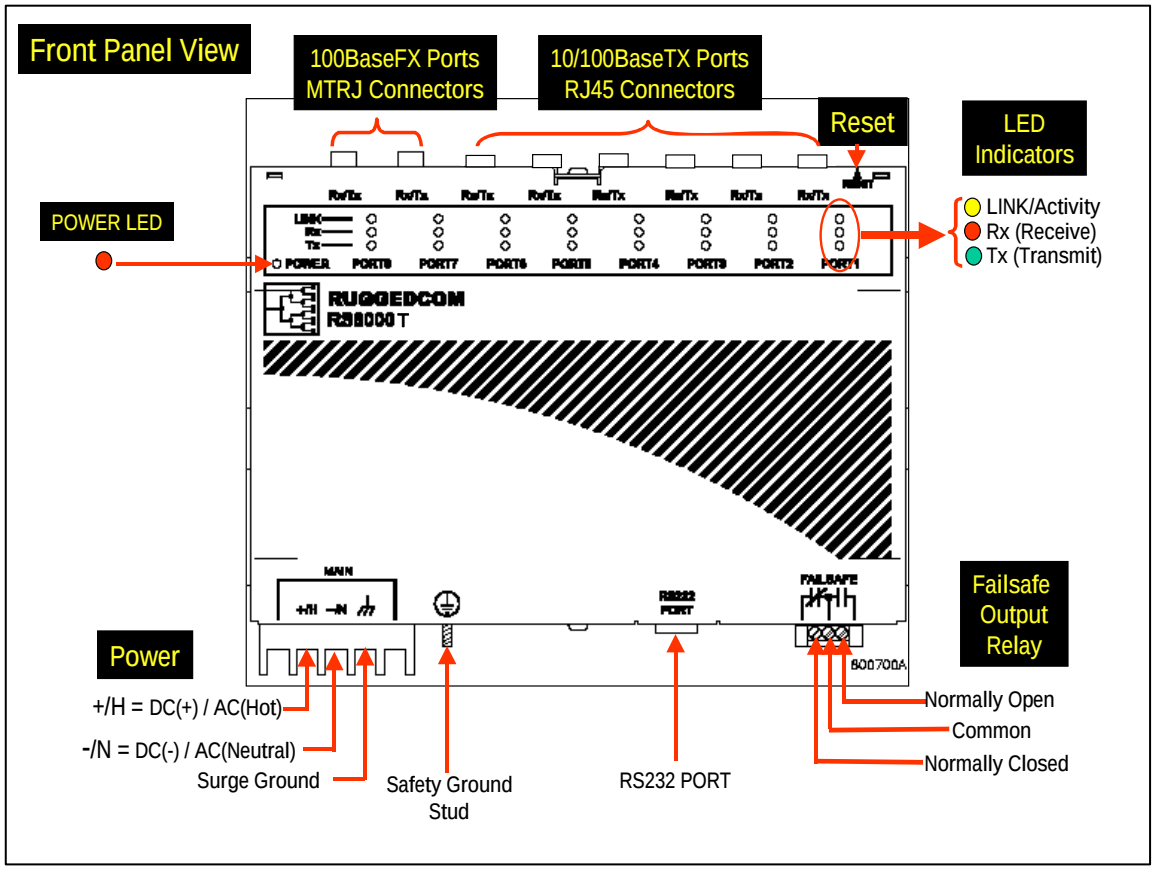



Fig. 1.4.1 RS8000 Family Front Panel Detail (Note: RS8000T Shown)

| *ITEM* | *Activity* | *Comments* |
|---|---|---|
| LINK LED (Yellow) | Solid | Link Established |
| | Blinking – Once per second | Tx, Rx Activity |
| Tx LED (Red) | Blinking | Tx (Transmit) Activity |
| Rx LED (Green) | Blinking | Rx (Receive) Activity |
| POWER LED (Red) | Solid | Power On |

## 1.5 RS8000 Family Top and Bottom View

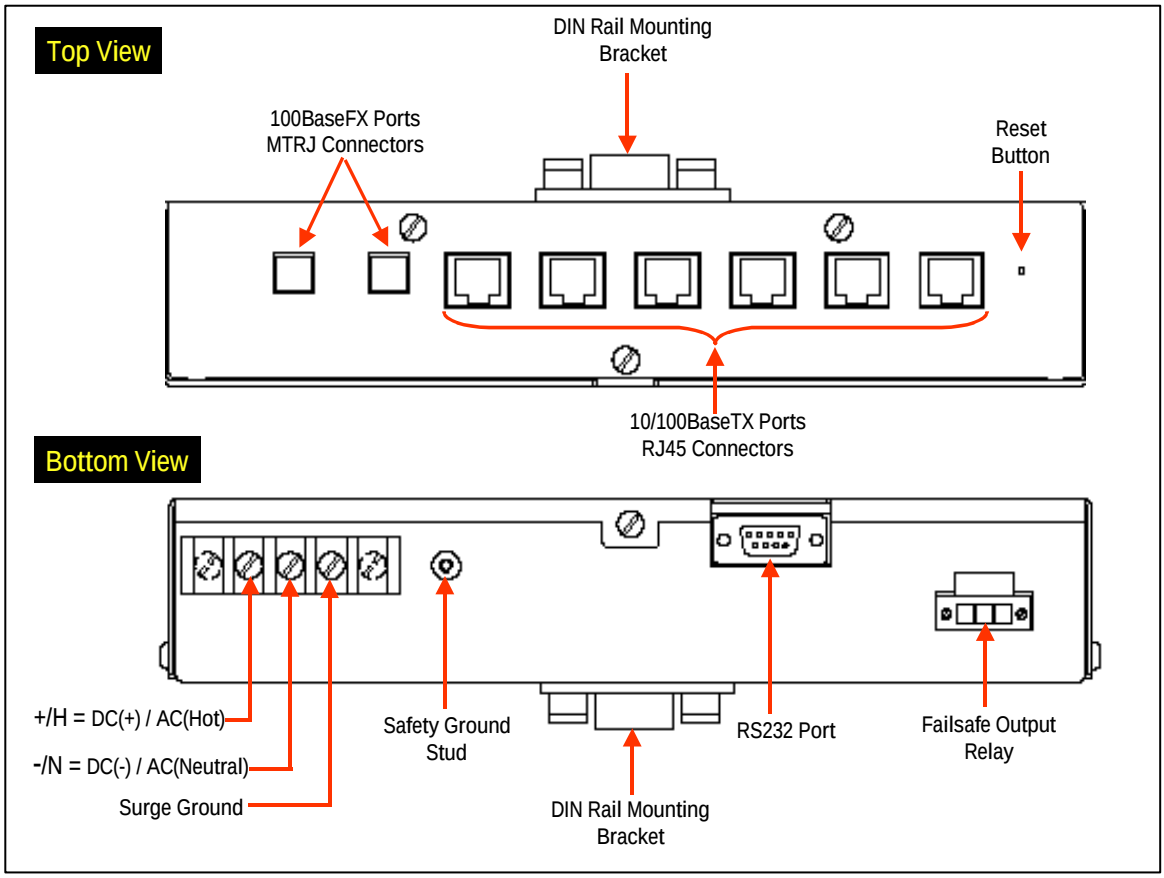



Fig. 1.5.1 RS8000 Family Top and Bottom View (Note: RS8000T Shown)

## 1.6 RS8000 Family Top Views (Other Models)

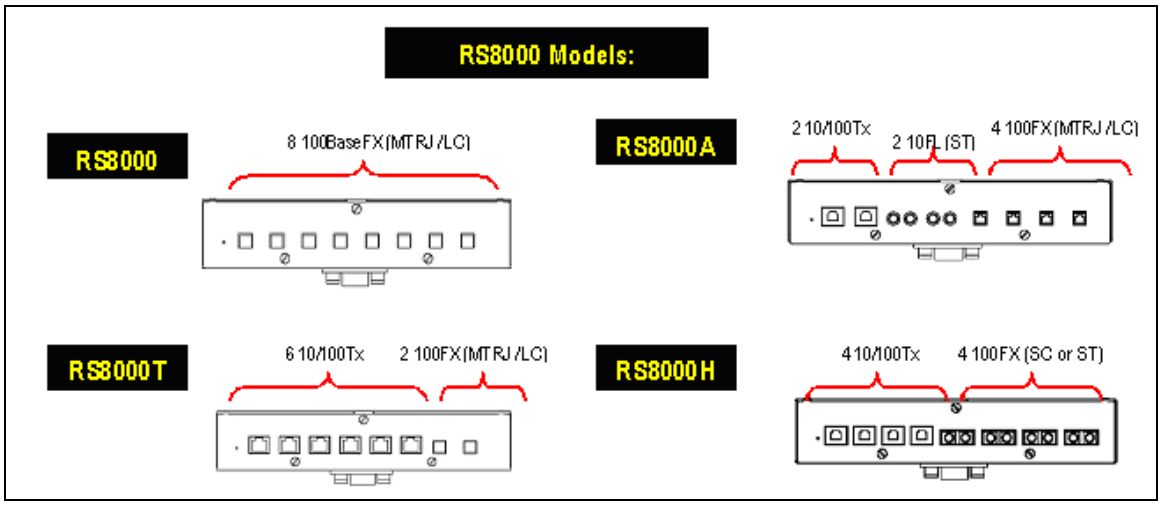



Figure 1.6 Top View of other RS8000 family models

# 2 Installation

## 2.1 DIN Rail Mounting

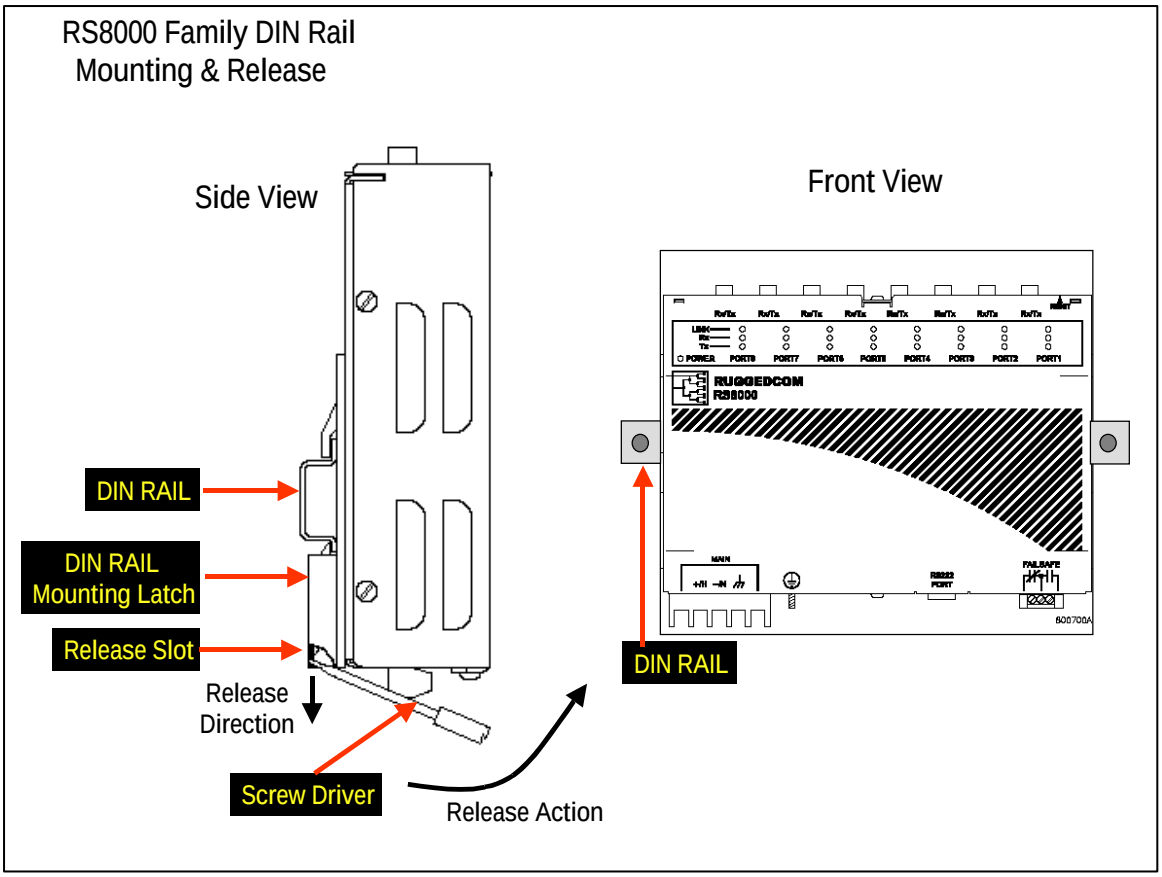



Fig. 2.1.1 RS8000 Family DIN Rail Mounting

## 2.2 Power Supply Wiring and Grounding

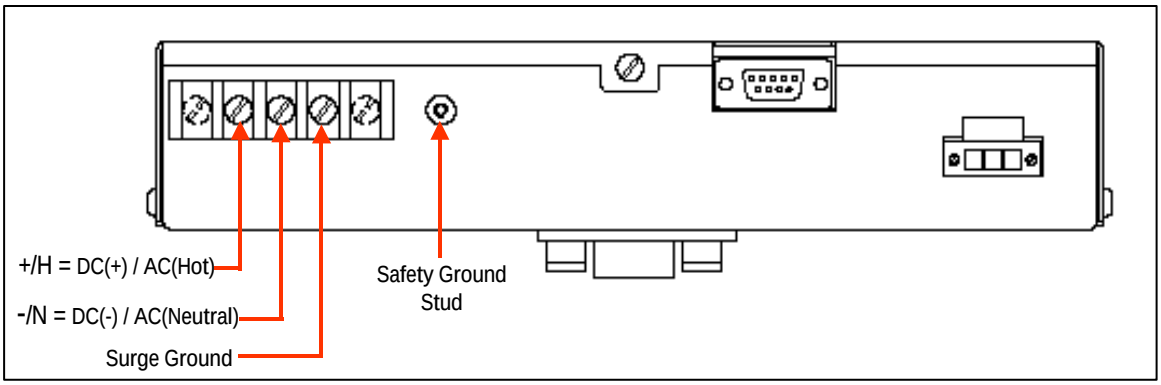



Fig. 2.2.1 RS8000 Family Power Supply Inputs

The RS8000 family power supply inputs are identical and are connected as follows:

1. +/H = DC (+) / AC (Hot) is connected to the positive (+) terminal if the power source is DC or to the (Hot) terminal if the power source is AC.
2. -/N = DC (-) / AC (Neutral) is connected to the negative (-) terminal if the power source is DC or to the (Neutral) terminal if the power source is AC.
3. Surge Ground is connected to the Chassis Ground via a braided cable or other appropriate grounding wire. Surge Ground is used as the ground conductor for all surge and transient suppression circuitry internal to the RS8000 unit. *NOTE: Surge Ground must be disconnected from Chassis Ground during HIPOT (dielectric strength) testing.*
4. Chassis Ground is connected to the Safety Ground terminal for AC inputs or the equipment *ground bus* for DC inputs.

*Notes:*

1. *88-300VDC Equipment: A 300VDC appropriately rated circuit breaker must be installed within 3m of the unit.*
2. *100-240VAC Equipment: A 250VAC appropriately rated circuit breaker must be installed within 3m of unit*
3. *A circuit breaker is not required for 12, 24 or 48 VDC rated equipment*
4. *Equipment must be installed according to the applicable country wiring codes.*

### 2.2.1 Power Supply - AC Input

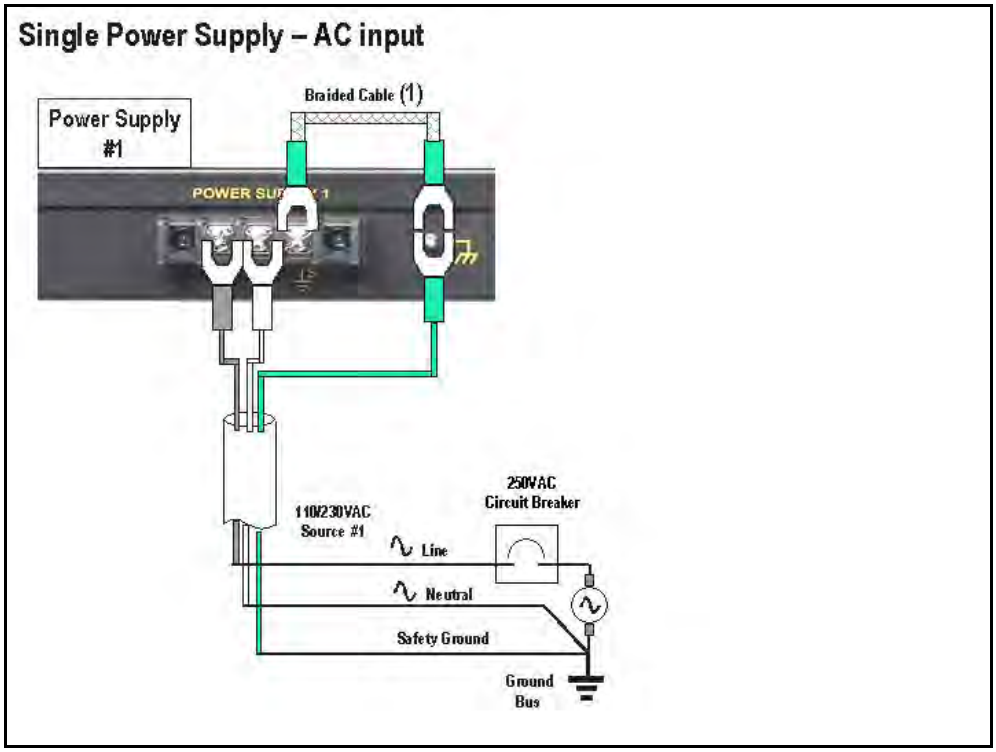



Fig. 2.2.2 Power Supply – AC Input

### 2.2.2 Power Supply – DC Inputs

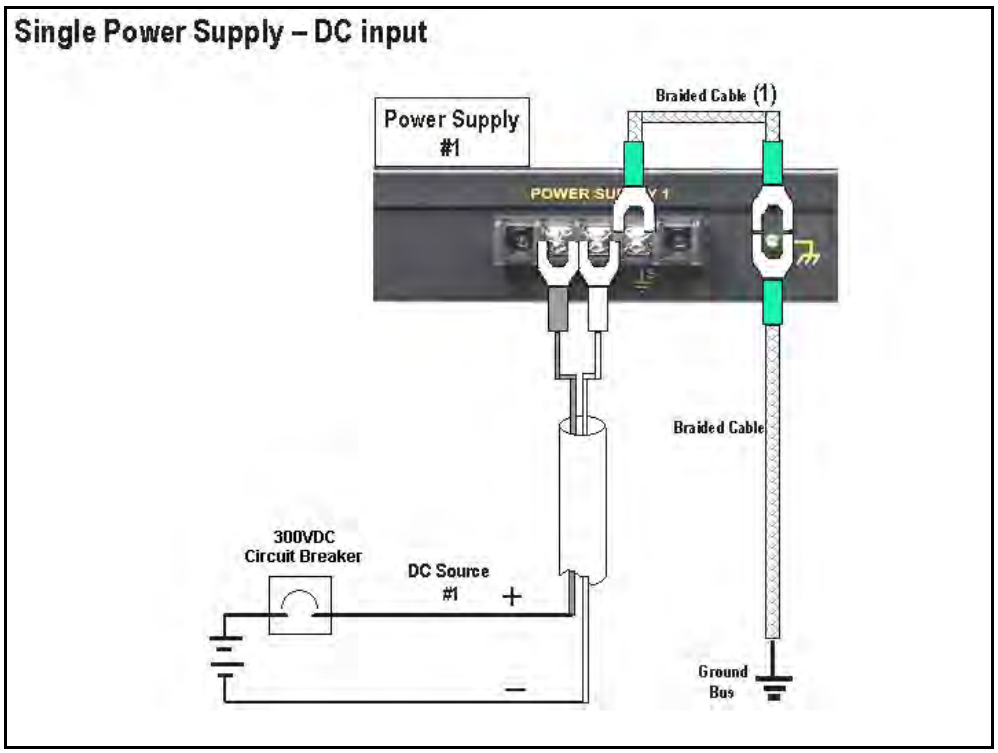



Fig. 2.2.3 Power Supply – DC Inputs

## 2.3 HIPOT (Dielectric Strength) Testing

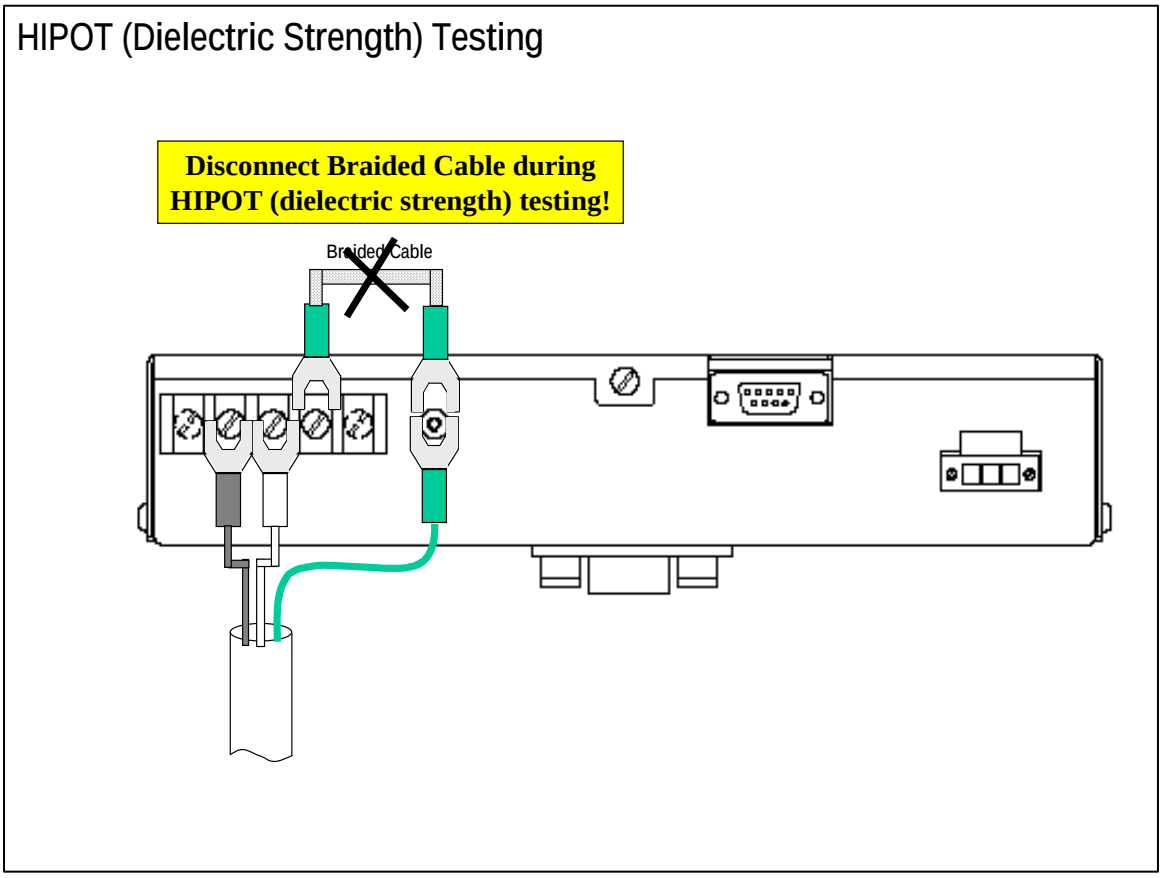

HIPOT (Dielectric Strength) Testing
Disconnect Braided Cable during HIPOT (dielectric strength) testing!
Braided Cable

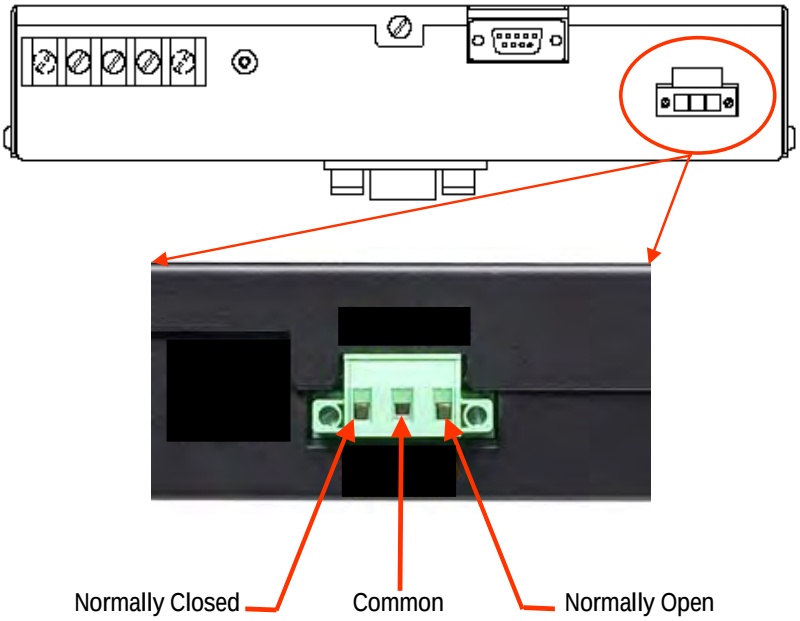
Fig. 2.3.1 HIPOT (Dielectric Strength) Testing

NOTE: Units which are to be “HIPOT” tested in the field must have the braided ground cable(s) disconnected (see Fig. 2.3.1) during the HIPOT test. This is required in order to prevent the transient/surge suppression circuitry, which is connected to Surge Ground (see Fig. 2.2.1), from being activated during the HIPOT test.

## 2.4 Failsafe Output Wiring and Specifications

The “Failsafe” output relay is provided to signal critical error conditions that may occur on the RS8000 series switch. The contacts are energized upon power up of the unit and remain energized until a critical error occurs. One common application for this output, regardless of whether the switch is managed or unmanaged, is to signal an alarm if a power failure or removal of control power occurs.

RS8000 Failsafe Relay Outputs




***** Normal contact state prior to power being applied to unit. *****

Fig. 2.4.1 RS8000 Family Failsafe Output Relay

## 2.5 RS232 Port Wiring

The RS232 port is used for configuring the unit. A straight-through serial cable with a DB-9 connector is required. There is no need to crossover the Transmit and Receive signals from the PC side since this has been done internally as shown in the figure below.

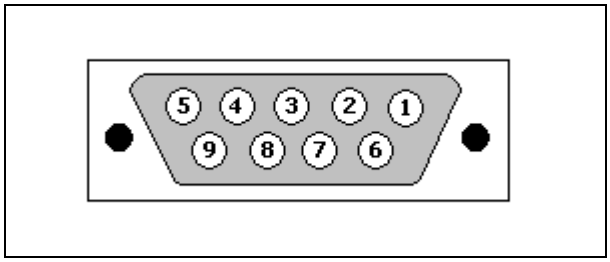



Fig 2.5.1 RS232 Female DCE pin-out

| *Pin* | *Signal* |
|---|---|
| 1 | No Connection |
| 2 | Transmit Data |
| 3 | Receive Data |
| 4 | No Connection |
| 5 | Ground |
| 6 | No Connection |
| 7 | No Connection |
| 8 | No Connection |
| 9 | No Connection |

Table 2.5.1 RS232 Female DCE pin-out

NOTE: This port is not intended to be a permanent connection and the cable shall be less than 2m (6.5 ft) in length.

## 2.6 RJ45 Ports – Signal Description

Units with 10/100Base-TX ports allow connection to standard Category 5 (CAT-5) unshielded twisted-pair (UTP) cable with RJ45 male connectors. The RJ45 receptacles are directly connected to the chassis ground on the unit and can accept CAT-5 shielded twisted-pair (STP) cables. If shielded cables are used, care must be taken to ensure the shielded cables do not form a ground loop via the shield wire and the RJ45 receptacles at either end. The figure below shows the shows the RJ45 port pin-out and LEDs.

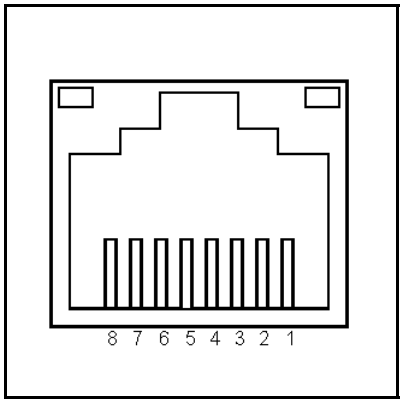



Figure 2.6.1

| *Pin* | *Signal* |
|---|---|
| 1 | +Rx |
| 2 | -Rx |
| 3 | +Tx |
| 4 | No Connection |
| 5 | No Connection |
| 6 | -Tx |
| 7 | No Connection |
| 8 | No Connection |
| Case | Shield (Chassis Ground) |

Table 2.6.1

NOTE: RuggedCom does not recommend the use of CAT-5 cabling of any length for critical real-time substation automation applications. However, transient suppression circuitry is present on all copper ports to protect against damage from electrical transients and to ensure IEC 61850-3 and IEEE 1613 Class 1 conformance. This means that during the transient event communications errors or interruptions may occur but recovery is automatic.

RuggedCom also does not recommended to use these ports to interface to field devices across distances which could produce high levels of ground potential rise, (i.e. greater than 2500V) during line to ground fault conditions.

# 3 Technical Specifications

## 3.1 Power Supply Specifications

| Power Supply Type | Minimum Input | Maximum Input | Fuse Rating | Maximum Power Consumption |
|---|---|---|---|---|
| 12 – 24 VDC | 10 VDC | 36 VDC | 6.3A(F) [2] | 15 W |
| 24 VDC | 18 VDC | 36 VDC | 5A(F) [2] | |
| 48 VDC | 36 VDC | 59 VDC | 3.15A(T) [2] | |
| HI (125/250 VDC) [1]<br>HI (110/230 VAC) [1] | 88 VDC<br>85 VAC | 300 VDC<br>265 VAC | 3.15A(T) [2] | |

NOTES:

1. This is the same power supply for both AC and DC.
2. (F) Denotes fast-acting fuse, (T) denotes time-delay fuse
3. For continued protection against risk of fire, replace only with same type and rating of fuse.

## 3.2 Failsafe Relay Specifications

| Parameter | Value |
|---|---|
| Max Switching Voltage | 30VAC, 80VDC |
| Rated Switching Current | 0.3A @ 30VAC<br>1A @ 30VDC, 0.3A @ 80VDC |

## 3.3 Twisted Pair Data Port Specifications

| Data Port | Media | Distance | Connector Type |
|---|---|---|---|
| 10/100 Mbps | Cat 5 UTP or STP | 100m | RJ45 |

## 3.4 Fiber Optical Specifications

| Speed Standard | Mode / Connector | Tx λ (nm) | Cable Type[2] (μm) | Tx Pwr (dBm peak)[3] (Min / Max) | Rx Sensitivity (dBm Average)[3] | Rx Saturation (dBm Peak)[3] | Typical Distance (km)[1] | Power Budget (dB) |
|---|---|---|---|---|---|---|---|---|
| 10BaseFL | MM / ST | 820 | 50/125 | -16.5/-10.6 | -34.4 | -11.2 | 2 | 21 |
| 10BaseFL | SM / ST | 1310 | 9/125 | -23/-15 | -38 | -3 | 15 | 18 |
| 100BaseFX | MM / ST | 1310 | 50/125 | -15.7 | -33.5 | -11 | 2 | 17 |
| 100BaseFX | MM / SC | 1310 | 50/125 | -16/-11 | -33 | -11 | 2 | 17 |
| 100BaseFX | MM / MTRJ | 1310 | 50/125 | -16/-11 | -33.5 | -11 | 2 | 17 |
| 100BaseFX | SM / ST | 1310 | 9/125 | -27 / -14 | -35 | -3 | 5 | 8 |
| 100BaseFX | SM / SC | 1310 | 9/125 | -13/5 | -31 | -4 | 20 | 20 |
| 100BaseFX | SM / LC | 1310 | 9/125 | -15/-8 | -31 | -5 | 15 | 16.5 |

Notes:

1. Maximum segment length is greatly dependent on factors such as fiber quality, and number of patches and splices. Please consult RuggedCom sales associates when determining maximum segment distances.
2. To convert from average to peak add 3dBm. To convert from peak to average, subtract 3dBm.
3. Single-mode is available as an option.

## 3.5 Type Test Specifications

| *Electrical Safety* | *Levels* | *Comments* |
|---|---|---|
| Dielectric Withstand | 2 kV rms for 1 minute | ANSI/IEEE C37.90 (1989)<br>IEC 60255-5 (Section 6) |
| High Voltage Impulse | 5 kV peak | IEC 60255-5 (Section 8) |
| Insulation Resistance | 500 VDC for 1 minute | IEC 60255-5 (Section 6 |

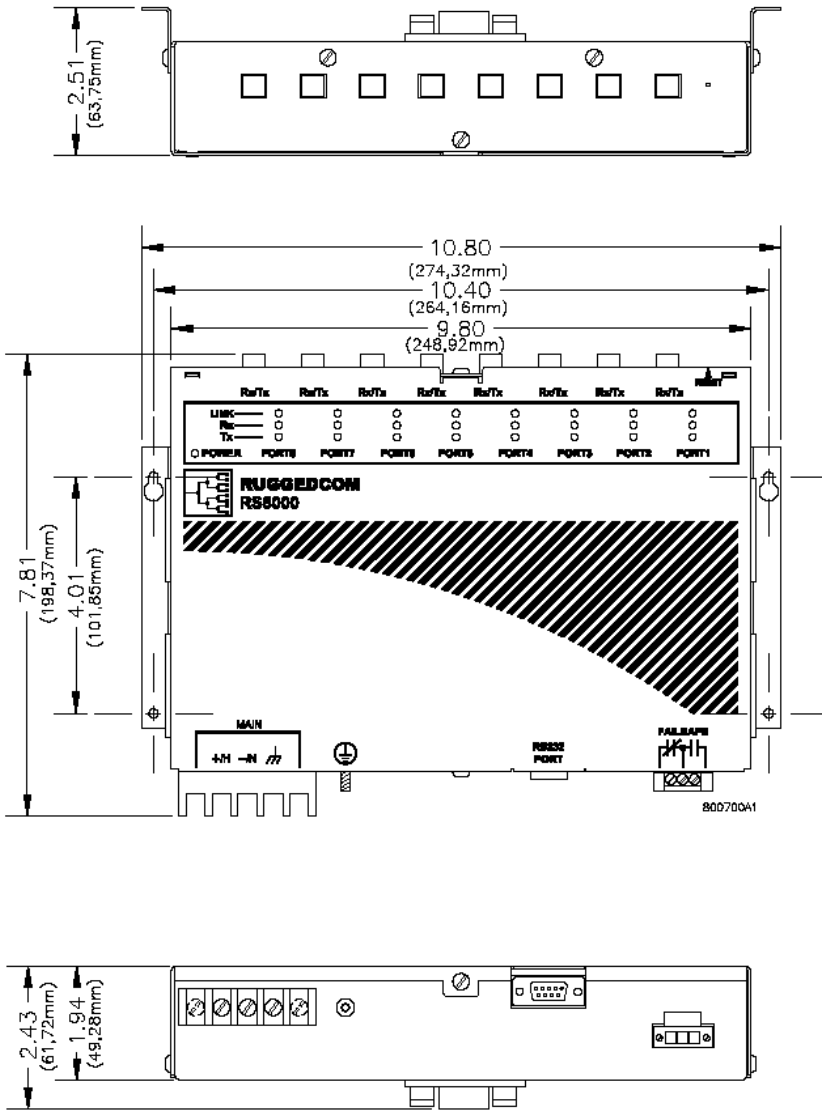
| *Electrical Environment* | *Levels* | *Comments* |
|---|---|---|
| High Frequency Disturbance (Oscillatory) | 2.5 kV @ 1MHz for 2s | ANSI/IEEE C37.90.1<br>IEC 60255-22-1 |
| IEC Surge | 4 kV / 2 kV | IEC 61000-4-5<br>(Level 4) |
| IEC Fast Transient | 2 kV / 1 kV | IEC 61000-4-4<br>(Level 4) |
| ANSI/IEEE Fast Transient | 4 kV | ANSI/IEEE C37.90.1 |
| IEC Radiated RFI Immunity | 10 V/m | IEC 61000-4-3 |
| ANSI/IEEE Radiated RFI Immunity | 35 V/m | ANSI/IEEE C37.90.2 |
| ESD<br>(Electrostatic Discharge) | 15 kV (air discharge)<br>8 kV (contact) | IEC 61000-4-2<br>(Level 4) |

| *Atmospheric Environment* | *Levels* | *Comments* |
|---|---|---|
| Temperature (Dry Cold) | -40°C | IEC 60068-2-1<br>Test Ad: 16 hrs @ -40°C |
| Temperature (Dry Heat) | 85°C | IEC 60068-2-2<br>Test Bd: 16 hrs @ 85°C |
| Humidity | 95%<br>non-condensing | IEC 60068-2-30<br>Test Db: 6 cycles, 55°C, 95% Humidity |

## 3.6 Operating Environment

| Parameter | Range | Comments |
|---|---|---|
| Ambient Operating Temperature | -40 to 85°C | Ambient Temperature as measured from a 30cm radius surrounding the center of the RS8000 enclosure. |
| Ambient Relative Humidity | 5% to 95% | Non-condensing |
| Ambient Storage Temperature | -40 to 85°C | |

## 3.7 Physical Dimensions



| Parameter | Value | Comments |
|---|---|---|
| Dimensions | 9.8 x 7.81 x 2.43 inches<br>(242,92) x (195,37) x (61,72) mm | (Length x Width x Height) |
| Weight | 5 lb (2.25 Kg) | |
| Enclosure | 18 gauge Galvanized Steel | |

### 3.8 Agency Approvals

| Agency | Standards | Comments |
|---|---|---|
| CSA, CE | CSA C22.2 No. 60950, UL 60950,<br>EN 60950<br>EN 61000-6-2 | Approved |
| FCC | FCC Part 15, Class A | Approved |
| CISPR | EN55022, Class A | Approved |

# 4 Warranty

RuggedCom warrants this product for a period of five (5) years from date of purchase. For warranty details, visit http://www.ruggedcom.com/ or contact your customer service representative.

Should this product require warranty or service contact the factory at:

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